Minutes from the June 27, 2003 Meeting of the Linear Collider Subcommittee of the Fermilab Long Range Planning Group

Present: M. Carena, J. Butler, S. Holmes, R. Kephart, R. Patterson, Y-K. Kin

Absent: S. Nagaitsev

Guests: D. Finley

Discussion of Fermilab Program in Support of Linear Collider R&D

Dave Finley is the coordinator for linear collider R&D at Fermilab. He described current activities at Fermilab in support of linear collider R&D. His transparencies can be found at:

http://tdserver1.fnal.gov/Finley/030627df020509MAC.pdf
http://tdserver1.fnal.gov/Finley/030627dfHARRY.pdf

Much (but not all) activities are centered in the RF Technology Development Group in the Technical Division. This group now includes ~15 people and pursues both warm and cold rf development in support of a variety of activities:

- NLC R&D
  - X-band accelerating structures for the 8-pack demonstration (at SLAC)
  - Industrialization of X-band accelerating structures
  - Girders

- FNPL (Fermilab NICADD Photoinjector Laboratory) improvements
  - 3rd harmonic (3.9 GHz) cavity

- CKM
  - 3.9 GHz deflecting cavities

- Muons
  - Lab G operations

In addition there is significant effort in support of site studies being pursued in the Facilities Engineering Services Section. (See Vic Kuchler/May 29 meeting).

A number of activities were being pursued within the Beams Division a year ago, but are now pretty much moribund due to diversion of resources into Run II:

- Permanent magnets
- X-band power
- Beam Physics

Goals and Status of Current Activities

The primary short term goal is the delivery of four, 60 cm long, damped/detuned accelerating structures to SLAC for utilization in the "8-pack" test scheduled for early next year. This test, which will deliver full power to final design structures, is regarded as a critical demonstration of NLC technology. Current status:

- The RF structures factory is up and running in IB-4. The primary issue at the moment is the furnace which is problematic. It is being retrofitted in August.

- After production of several short model structures, three detuned structures (referred to as model FXB, serial numbers 002, 003, 004) have been delivered to SLAC and powered at the NLCTA. These structures have all been brazed (not bonded) within a variety of H_2 atmospheres. They are performing well at NLCTA (at least as well as other structures in the facility, although breakdown rate is still too high). Three more are in the pipeline and should be completed in late September.
- Parts are on order for the next generation damped/detuned structure (referred to as model FXC). Four are planned for production over November-March.
- These will be followed by the final(?) damped/detuned design (model FXD). Production is scheduled to start next March.

The overall rate of production is about 1 structure/month and is limited by the furnace.

A technology decision is expected from the ILCSC in summer of 2004. The plan for FXD's beyond this point depends upon the decision.

Future

What should Fermilab be doing to become a lead player if the decision is to go with a warm (X-band) linac?

- Industrialization of structures
  This is what Fermilab originally signed on for. It's still a very big deal: the production rate of structures needs to be 10-15/day to support a construction project. The current process does not extrapolate to the required rate, even with massive parallelization. So achievement is going to require innovative thinking on fabrication, assembly, and QC techniques (forging of blanks, laser welding, vendor feedback methodologies, etc.).

- Engineering Test Facility
  This is also an original Fermilab idea that went on the back burner when the X-band structures ended up back in R&D phase. The concept is a preproduction project that produces 0.5-1.0% of the main linac to work out many issues related to reliable linac performance. The construction of such a facility would establish Fermilab capabilities independent of whether the LC was located at Fermilab or some place else.

- Girder design
  We have been assigned responsibility for this component and should continue.

- X-band power source
  High power testing will be required as part of the QC associated with structures production. There was not a consensus among those present whether this needed to be at Fermilab, at the production site, or elsewhere. It was noted that conditioning times are weeks so the penalty in shipping a structure across the country is not severe.

- Accelerator Physics
  There was a strong consensus that leadership in accelerator physics design activities is a pre-requisite to construction of a linear collider on or near the Fermilab site. The (original) "SNS Model" was rejected, and the current SNS situation (a strong accelerator physics group assembled) used as the example.

- Site/Civil Design Activities
  These will be closely associated with the selected site.

What should Fermilab be doing to become a lead player if the decision is to go with a cold linac? This was a little more problematic given that DESY currently holds the SCRF expertise and SLAC the beam delivery expertise.

- Site/Civil Design Activities
  These will be closely associated with the selected site, independent of whether it is warm or cold.

- Develop U.S. SCRF vendor capabilities
  There was no consensus on this. Everyone agreed that multiple vendors/supply lines need to be involved, but there was no agreement on the necessity of one being in the U.S.

- 8 GeV SC (proton) linac
  This was pointed to as a project that could establish our credibility in addition to providing a pre-production demonstration project. A discussion ensued on the timeline. I believe there was a feeling that it may not make sense in terms of a FY2009 linear collider construction start, but would if this were delayed a few years (as deemed likely, at least by us).

- Injector
  Fermilab built the injector for TTF so we have established capabilities here. The damping rings also appear to be up for grabs.

- Knick-knacks
  Infrastructure (controls): Makes sense only if LC is at Fermilab
  Modulators: We have lots of expertise and experience (with TTF modulators)

Resources?

It was felt a model where $300M a year is ultimately going into the R&D program at its culmination requires many hundreds of people. **We need to get to a staff evolution model connected to this.**

GDC (Global Design Center)?
The ILCSC is discussing formation of a GDC (see May 22 minutes). Should Fermilab bid to host this? **I would like further discussion when we get to internationalization.**

Next Meeting
July 10, 10:30-Noon, on the 7th floor cross-over.

Agenda:
1. Detector R&D – arranged by Joel and Ritchie

2. Plans for subsequent meetings - Steve